rotating by means of a ridge on its inner surface and a corresponding groove on the upright bar. This cylinder carries the writing arm and stylus, which registers on the cylinder the rising and falling of the former; l is the motive power of the cylinder m. The apparatus for detaching the falling weight g is not shown in the diagram, but might be of the following arrangement:—A bob suspended by a spiral spring is made to make contact with a cup of mercury, as in the old form of vertical seismometers, besides a small lever of the first order attached at one end to the bob, the other extremity being above another cup of mercury. In this way, whether the movement of the bob be either up or down, in relation to the mercury cups, contact will be either made in the first case through the lever, or in the second directly by the bob. The current thus established could be used by an electromagnetic apparatus for removing a catch which holds the weight g. It could also start the cylinder m and stop a clock. The diagram will sufficiently explain the action of the apparatus.

If we review the advantages and disadvantages of the different instruments, I venture to say that, though far from perfection, they have much to be said in their favour. Their principal feature is the capability of registering continuously all the variations of the earth's movement during the complex disturbance known as an earthquake; that by employing large tracing drums with a spiral arrangement and time-ruled paper, accurate time-records can be obtained for a considerable period and without interruption, so that a single observer could have under his command a large number of instruments, even at stations some considerable distance apart, thus resulting in much economy of trained observers. Then again the records are all permanent, being graphically inscribed. The instruments for registering azimuth and amplitude, and capable of doing so with the greatest delicacy and friction, in all cases can be reduced to a minimum, or easily calculated. With regard to the registration of the vertical component of an earth-wave, the old form of spiral spring and bob principle may be excluded from consideration as perfectly unreliable; and even the improvements by Messrs. Milne and Ewing, and the ingenious idea of Mr. T. Gray, with its mercury trough compensator, cannot give accurate indication of the characters of a group of earth-waves. Another instrument worthy of trial is the hydrometer vertical-motion seismograph of Mr. T. Gray (*Phil. Mag.*, September 1881, p. 209). I think, however, that this instrument might be improved by using a long thin glass tube filled with air and floating in ether or some other fluid of very low viscosity. I would, however, venture to predict that a seismometer based on the principle of a falling weight, being accelerated or retarded according as the earth moves up or down, will supersede other methods, although no doubt such means of registering as described in this paper may be greatly improved upon.

The instruments described in this paper are all of considerable size, but it seems impossible to get good results unless heavy weights and their attendant mechanisms are used so as to reduce friction to a minimum in the consideration of results; for it is certainly a pity to have imperfect results in consequence of limiting the size of the apparatus. One great objection to the falling weight seismometer is the necessity for a deep well, to give sufficient time to register an earthquake of ten or twenty or even more seconds' duration; yet, by giving the weight more work to do by the introduction of multiplying wheels, this might be reduced as the circumstances might demand.

These instruments and the remarks on them are the outcome of long meditation while wandering over the ruins of two great earthquakes, and although expressed without a technical knowledge of mechanical construction, I hope I have made my ideas sufficiently clear.

H. J. JOHNSTON-LAVIS

INTERNATIONAL WEIGHTS AND MEASURES

IN inviting attention to the work done at Sèvres during the past year by the Comité International des Poids et Mesures,[1] we are glad to have the opportunity of congratulating those interested in accurate measurement on the fact that this country is now to be represented on the Committee, and will thus have a voice in their discussions. This, as we have pointed out on previous occasions, appears to be required of a country so largely interested in scientific research as ours.

METRES

Description of Standard	Error in terms of the true standard metre ($I_{2(a)}$—6μ)	Mean coefficient of dilatation, 0° to t° C.
Standard I_2, which serves as the provisional standard of the Comité until the final prototype is verified ...	μ + 6·00	$10^{-9}(8594{\cdot}6+1{\cdot}26t)$
Standard I. for the use of the Bureau	+ 76·04	$10^{-9}(8602{\cdot}9+2{\cdot}09t)$
Standard II. for the use of the Bureau	+ 80·61	$10^{-9}(8569{\cdot}1+2{\cdot}79t)$
Standard III. for the use of the Bureau	+ 14·53	$10^{-9}(8560{\cdot}0+1{\cdot}63t)$
Standard XIII., belonging to French section of the Comité	+ 3·05	$10^{-9}(8540{\cdot}6+2{\cdot}62t)$
Bronze subdivided Standard N belonging to the Comité	+ 48·58	$10^{-9}(17483+7{\cdot}07t)$
Brass Barometer-Standard T_1 belonging to Comité, constructed by Société genevoise pour la Construction d'Instruments de Physique	− 7·2	$10^{-9}(18178+7{\cdot}9t)$
Brass Barometer-Standard T_2	− 31·6	$10^{-9}(18213+7{\cdot}2t)$
,, ,, T_3	− 0·5	$10^{-9}(18037+4{\cdot}7t)$
Brass Barometer-Standard constructed by Messrs. Hermann and Pfister, P...	− 149·3	$10^{-9}(18821+8{\cdot}4t)$
Platinum Standard for Spain originally constructed by Froment with lines traced by J. Alfonso, Secretary to Standards Commission at Madrid, E	+ 4·95	$10^{-9}(8898)$
Iron Standard of the United States Government made by Repsold, US	+ 97·8	$10^{-9}(10563)$
Standard for Office of Weights and Measures at Vienna, H_A	+ 14·1	$10^{-9}(18708+3{\cdot}00t)$
Standard for Office of Weights and Measures at Vienna, A_A	− 8·9	$10^{-9}(17971+3{\cdot}15t)$
Iron Standard of Société genevoise, F	− 31·4	$10^{-9}(11063)$
Brass Standard of Société genevoise, L	− 62·6	$10^{-9}(19155)$
Bimetallic Standard for French War Department, constructed by Porro—		
Brass, C	− 111·8	$10^{-9}(18699)$
Steel, A	+ 31·1	$10^{-9}(10420)$
Copper Standard for M. Tresca, Cu	+ 10·7	$10^{-9}(16334+5{\cdot}82t)$
Green Glass Standard made by M. Baudin for thermometric purposes, V... ...	+ 128·2	$10^{-9}(8392+4{\cdot}8t)$

[1] "Travaux et Mémoires," tome iii. 400 pages. (Paris: Gauthier-Villars, 1884.

Kilogrammes		mgr.	mgr.
International kilogramme KI belonging to the Bureau ...		—	—
International kilogramme KIII belonging to the Bureau ...	KI—KIII =	−0·1232	±0·0026
Kilogramme-type C belonging to the Bureau	C—KIII =	+0·3217	±0·0034
Kilogramme-type S belonging to the Bureau	S—KIII =	+0·4632	±0·0034
Standard kilogramme H for Spain	H—KIII =	−1·8762	±0·0034
Standard kilogramme Z for Austria	Z—KIII =	−1·3501	±0·0034

The present volume, like its two predecessors, is published by the Director of the Bureau under the authority of the Comité, and contains some account of the modes of comparison of the standards, with descriptions of the apparatus used, and a complete statement of the observations and of the methods of their reduction. The work of the Bureau has mainly included determinations of the lengths of certain standard metres and of the weights of certain standard kilogrammes for different Governments and authorities, as shown in the above tables.

These tables do not include the important comparisons of the British Standards with those of the Bureau, an account of which is given in a Report presented to Parliament by the Board of Trade last year, and in the Report of the Proceedings of the Committee for 1883.

The comparisons of the metres by Dr. René-Benoit, and those of the kilogrammes by M. Marek, were made in the same manner and after the same methods as those described in vols. i. and ii., to which we have previously referred.

M. Marek gives a thoughtful description of the excellent normal barometer and cathetometer in use at the Bureau, as well as of the methods of calibrating the thermometers used during the weighings. There are also illustrations of the apparatus used in ascertaining specific gravities, and of M. Stas's method for clearing the surfaces of metals by a jet of alcohol vapour, of which we regret that the demands on our space do not allow an account.

The many pages of observations and calculations which are given in this volume are clearly arranged and carefully printed. We doubt, however, whether it may be desirable to publish so much detail, particularly all the observations of the balances. Each Report of verification should evidently include all the observations, &c., from which the results have been obtained, but it would appear to be necessary only that the Government or authority directly interested should be furnished with a full detailed Report. Economy of time and money might be effected to readers and purchasers, and perhaps the objects of the Comité further advanced, by the omission in such publications of any unnecessary detail.

NOTES

THE Washington Prime Meridian Conference has adopted a resolution declaring the universal day to be the mean solar day, beginning, for all the world, at the moment of mean midnight of the initial meridian, coinciding with the beginning of the civil day, and that meridian to be counted from zero up to twenty-four hours. The resolution further declares that the Conference expresses the hope that, as soon as practicable, astronomical and nautical days may be arranged everywhere to begin at mean midnight. Prof. Janssen, of France, moved that the Conference should express the hope that technical investigations to regulate and extend the application of the decimal system to the divisions of the circle and of time would be resumed, in order to permit of the extending of that application to all cases where it might present real advantages. The motion was adopted, and the Conference adjourned until Wednesday.

M. BERTRAND, the Perpetual Secretary of the Paris Academy of Sciences in the Mathematical Section has been proposed as a candidate to fill the place vacated by the death of M. Dumas in the Académie Française. His nomination is certain, and will take place without opposition. It is almost customary for the Académie Française to offer a seat to one of the secretaries of the Academy of Sciences; Delambre, Fourier, Flourens, Cuvier, and Dumas enjoyed this honour in succession. Arago was offered it several times, but obstinately refused it. He strictly adhered to the old constitution of the Institut National as created by the Directory of the First Republic, which states that the five sections constitute the several parts of a living encyclopædia established to deliberate *in common* on many different questions, and that consequently no member of one section should be eligible to another. When the Restoration took place, the Institut was divided into independent academies, and the old practice of electing a person to several of them was revived. It has not been altered since 1848, although several attempts have been made in order to recall into existence the former republican organisation.

ON the night of Saturday, October 4, some interesting observations of lunar coronas and fog-bows were made at Ben Nevis Observatory. The mountain-top had been enveloped in mist for several days previously, but about 9 p.m. it began to clear, and by 11 o'clock the moon, partially eclipsed, was visible, surrounded by a strong double corona; all the colours from red to blue being seen in both rings. Measurements of these were taken by Mr. Dickson, Interim-Superintendent, with an instrument designed for the purpose by Prof. Tait. These gave:—Outer diameter of red—outer ring, 7° 46′; inner ring, 4° 52′. After midnight the sky became quite clear and the moon shone brightly, no corona being visible. At times, however, detached portions of very thin mist came up the north-west side of the mountain and brushed over the top. Whenever this occurred a strong corona again surrounded the moon, with a *third* set of rings, outside the other two, and much fainter, but sufficiently bright to allow of all the colours being distinguished. At 1.30 a.m. on October 5 the outer set of rings was more distinctly marked than before, and measurements were again taken. These gave:—Outer diameter of red—inner ring, 4° 6′; middle ring, 6° 2′; outer ring, 8° 10′. All these measurements are subject to an error of not more than ± 6′. At 1.15 a.m. a lunar fog-bow was visible on a fog bank to the northwards. From the edge of the precipice to north-north-east of the Observatory this appeared to consist of an outer ring, having a diameter of 75°, and an inner and fainter ring, diameter 65°, the space between the rings appearing almost quite dark, as if caused by a sharply-defined break in the fog. No colours could be distinguished.

FROM the *Alta California* we learn that the Lick Trustees have just received, through the kindness of Capt. Goodall, of the firm of Goodall, Perkins, and Co., important advices from Paris in regard to the glass disk which is needed to complete the 36-inch equatorial for the Lick Observatory. It will be remembered that the contract for two disks—one of flint and the other of crown glass—which are needed for the construction of an achromatic objective, was let to the celebrated firm of Alvan Clark and Sons in 1861. There were only two firms in the world who were capable of making glass disks of such size, nearly 40 inches in diameter. The Clarks employed one of these, Messrs. E. Feil and Co. of Paris, to cast the rough disks for them. The flint disk was cast in an unexpectedly short time, but the making of the crown glass disk has proved to be a matter of great difficulty, and this alone will have delayed the making of the large objective, and thus the completion of the Lick Obser-